- Please replace the ninth full paragraph on page 3 with the replacement paragraph set forth below:

Figures 8(a) and 8(b) show, respectively, a circuit similar to that shown in Figure 6(a) but with double-ended open stubs **[830, 850]** in places of the closed loops **[630]** in Figure 6(a), and the simulated frequency response for the circuit in Figure 8(a).

A3

- Please replace the first full paragraph on page 6 with the replacement paragraph set forth below:

In Figure 4, which shows an equivalent circuit of the circuit in Figure 2, the longer segment 220 is represented by an ideal transmission line **420**, and the shorter segment **230** by another ideal transmission line **430**. V_1 and V_2 are the voltages from node 1 (**440**) and node 2 (**450**) to the ground, respectively. Because the electrical length of the transmission line 230 is nearly zero, $V_1 \approx V_2$ and $I_{S1} \approx I_{S2}$. The output current, I'_2, is therefore

A4

$$\begin{aligned} I'_2 &= I_{S2} + I_{L2} \\ &\approx I_{S1} + I_{L2} \\ &= I'_1 - I_{L1} + I_{L2} \\ &= I'_1 - (I_{L1} - I_{L2}) \qquad (2) \end{aligned}$$

- Please replace the first full paragraph on page 8 with the replacement paragraph set forth below:

The circuit based on the principles of the invention may be made of a variety of conductive materials formed on a dielectric layer. Suitable conductive materials include metals such as copper or gold, superconductors such as, niobium or niobium-tin, and oxide superconductors, such as YBCO. Any suitable dielectric material may be used. Examples include alumina, DUROID (a dielectric), magnesium oxide, sapphire or lanthanum aluminate. Methods of deposition of metals and superconductors on substrates and of fabricating devices are well known in the art, and are similar to the methods used in the semiconductor industry.

A5

- Please replace the second full paragraph on page 7 with the replacement paragraph set forth below:

A6

Referring to Figures 5(a) and 5(b) and 6(a) and 6(b), a single resonator designed based on the principles of the invention is illustrated (Figures 6(a) and 6(b)) and compared with a single resonator design using patch shunt capacitors (Figures 5(a) and 5(b)). The microstrip filter **500** in Figure 5(a) includes two transmission line segments **510** at the two ends (the input and the output). Between the two segments 510 and separated therefrom by gaps **520** are two conductive patches **530** connected by a zigzag transmission line **540**. The patches 530 primarily function as shunt capacitors, and the transmission line 540 primarily functions as an inductor. In the embodiment shown in Figure 5(a), the substrate has a size of 512 x 256 mils, thickness 20 mils and dielectric constant about 10.

- Please replace the first full paragraph on page 8 with the replacement paragraph set forth below:

A7

Figures 5(b) and 6(b) show, respectively, the simulated frequency response curves of the circuits shown in Figures 5(a) and 6(a). Both responses include a dominant resonant mode around 2.1 GHz. Where they differ significantly is in the harmonics: The first harmonic for the circuit in Figure 5(a) is higher than 5 GHz, whereas the first harmonic for the circuit shown in Figure 6(a) is around 4.6 GHz. Thus, the circuit using closed conductive loops (i.e. Figure 6(a)) may be an suitable alternative to the circuit using patch shunt capacitors in the frequency range near the first harmonic.

- Please replace the first full paragraph on page 8 with the replacement paragraph set forth below:

A8

As another example, the circuit shown in Figure 8(a) is otherwise the same as that in Figure 6(a) except that the closed loops 630 are replaced by a pair of open-ended stubs **850** and **860**. The frequency response (Figure 8(b)) of the circuit with the stubs is also significantly different from that shown in Figure 6(b). The circuit shown in Figure 8(a) is essentially the one in Figure 6(a) with only a small gap formed in the otherwise closed loop **830**. In theory, if the

A8

two open-end stubs 850 and 860 are perfectly symmetrical and balanced and each open-end has exactly half length of the loop shown in Figure 6(a), the filter may achieve a frequency response similar to that shown in Figure 6(b). However, it is difficult to realize such perfect symmetry in practice, and the spurious response as shown in Figure 8(b) (for example, near 3.3 GHz) would be difficult to avoid.

- Please replace the first full paragraph on page 9 with the replacement paragraph set forth below:

A9

Referring to Figures 9(a), 9(b) and 10(a), 10(b), a microstrip low-pass filter designed based on the principles of the invention is illustrated (Figure 10(a)) and compared with a design using patch shunt capacitors (Figure 9(a)). The filter **1000**, shown in Figure 10(a), includes the closed conductive loops **1020** and **1040**, which substitute, respectively, the conductive patches **920** and **940** in the circuit shown in Figure 9(a). The total surface areas occupied by the closed loop capacitors 1020 and 1040 in Figure 10(a) is over 30 percent smaller than that occupied by the patch capacitors 920 and 940 in Figure 9(a). The transmission lines **1030** in the circuit of the invention differ in shape from those 930 in Figure 9(a), but are approximately the same width and total length.

- Please replace the first full paragraph on page 10 with the replacement paragraph set forth below:

A10

Figure 11 illustrates a shunt capacitor realized by a closed conductive loop in a multilayer structure. In the particular embodiment, the loop **1100** extends into three conductive layers separated by dielectric layers (not shown). A first portion **1120** lies in the lower conductive layer; a second portion **1130** lies in the middle layer, with vertical conductive paths **1140** electrically connecting the two portions. A third portion **1150** lies in the top conductive layer, with another pair of vertical conductive paths **1160** connecting the middle 1130 and upper 1150 portions. This multilayer structure dramatically reduces the footprint of the shunt capacitor, In contrast, a patch shunt capacitor in a multilayer configuration would not significantly reduce the footprint of the circuits.

- Please replace the paragraph beginning on page 10, line 11 and ending on page 11, line 1 with the replacement paragraph set forth below:

To further illustrate the principles of the invention, a five-pole band-stop filter built on 20 mil thick MGO substrate with YBCO thin-film high-temperature superconductor is shown in Figure 12. The filter **1200** includes a transmission line **1210** that includes four serially connected swirl transmission line portions **1240A, 1240B, 1240C** and **1240D**. The input and output ends of the filter 1200, as well as the junctions between the pairs of adjacent transmission line portions **1240**, are connected to their perspective shunt branch resonators **1220A, 1220B, 1220C, 1220D** or **1220E**, which may be identical to each other. Each shunt branch resonator **1220** includes an interdigitized capacitor **1222** in parallel with an inductor **1224**. The parallel combination may also be realized by a frequency-transformed inductor. The resonator is coupled to the transmission line **1210** by a capacitor **1226**. The resonators may be of any suitable configuration. Examples of the components, including interdigitized capacitors and frequency-transformed inductors are disclosed in the U.S. patent applications serial numbers 08/706974, 09/040578 and 09/699783, which are incorporated herein by reference.

A11

- Please replace the first full paragraph on page 11 with the replacement paragraph set forth below:

A12

The input and output ends of the filter 1200, as well as at the junctions between pairs of adjacent inductors 1240, are also connected to their respective shunt capacitors **1230A, 1230B, 1230C, 1230D** and **1230E**, which are realized by closed conductive loops of varying sizes.

In the Drawings

Please replace Figure 1(a) with replacement Figure 1(a) submitted herewith. Replacement Figure 1(a) has proposed amendments (removal of all reference numeral 110) shown in red for approval by the Examiner. Upon approval, new drawings in compliance with 37 C.F.R. §1.84 will be filed in due course.

Please replace Figure 1(b) with replacement Figure 1(b) submitted herewith. Replacement Figure 1(b) has proposed amendments (removal of reference numeral 120) shown

in red for approval by the Examiner. Upon approval, new drawings in compliance with 37 C.F.R. §1.84 will be filed in due course.

Please replace Figure 1(c) with replacement Figure 1(c) submitted herewith. Replacement Figure 1(c) has proposed amendments (removal of reference numeral 130) shown in red for approval by the Examiner. Upon approval, new drawings in compliance with 37 C.F.R. §1.84 will be filed in due course.

Please replace Figure 1(d) with replacement Figure 1(d) submitted herewith. Replacement Figure 1(d) has proposed amendments (removal of reference numeral 140) shown in red for approval by the Examiner. Upon approval, new drawings in compliance with 37 C.F.R. §1.84 will be filed in due course.

Please replace Figure 2 with replacement Figure 2 submitted herewith. Replacement Figure 2 has proposed amendments (removal of reference numerals (1) and (2)) shown in red for approval by the Examiner. Upon approval, new drawings in compliance with 37 C.F.R. §1.84 will be filed in due course.

Please replace Figure 6(a) with replacement Figure 6(a) submitted herewith. Replacement Figure 6(a) has proposed amendments (reference numerals edited to use "6" as the leading digit) shown in red for approval by the Examiner. Upon approval, new drawings in compliance with 37 C.F.R. §1.84 will be filed in due course.

Please replace Figure 7(a) with replacement Figure 7(a) submitted herewith. Replacement Figure 7(a) has proposed amendments (reference numerals edited to use "7" as the leading digit) shown in red for approval by the Examiner. Upon approval, new drawings in compliance with 37 C.F.R. §1.84 will be filed in due course.

Please replace Figure 9(a) with replacement Figure 9(a) submitted herewith. Replacement Figure 9(a) has proposed amendments (removal of reference numerals 900 and